APS

Mapping Epitaxial Interfaces

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Epitaxial heterostructures constitute a large fraction of the materials systems used in current optoelectronics technology. As device dimensions continue to shrink to the nanoscale, atomic interfaces play an increasingly dominant role in their characteristics and performance. Moreover, new classes of devices are envisioned based on novel phenomena emerging from the complex ionic and electronic rearrangements occurring at interfaces. Energy harvesting, quantum information processing, and smart sensors are but a few of the possible applications. An essential requirement for harnessing these transformative developments is to provide accurate and detailed maps of the structure, chemical composition, and strain at epitaxial interfaces prepared by various deposition methods, including molecular beam epitaxy, metallorganic chemical vapor deposition, focused ion beam and pulsed laser deposition. This presentation will describe some of the exciting science drivers on the APS-U horizon, in the context of the proposed X-ray Interface Science (XIS) sector. Examples include the use of direct methods for achieving sub-Ångstrom resolution maps of complex oxide interfaces, quantum-dot tailoring, and the prospects for *in situ*, real-time X-ray interface microscopy. Such experiments will allow us to understand how local structure can give rise to novel macroscopic properties. Ongoing developments in X-ray optics, pixel area detectors, and real-space and real-time techniques will converge to realize extremely interesting science opportunities at the new XIS facility.

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